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APPLICATION NUMBER: *60/115,231*
FILING DATE: *January 08, 1999*

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Docket Number:	100/00798

PROVISIONAL APPLICATION FOR PATENT COVER SHEET (Small Entity)

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53 (c).

INVENTOR(S)/APPLICANT(S)		
Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
Alon	ATSMON	Yehud, Israel

☐ Additional inventors are being named on page 2 attached hereto

TITLE OF THE INVENTION (280 characters max)

COMPUTER COMMUNICATION

CORRESPONDENCE ADDRESS

Direct all correspondence to:

☐ Customer Number [ ] → Place Customer Number Bar Code Label here

OR

☒ Firm or Individual Name	William H. Dippert, Esq.				
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ENCLOSED APPLICATION PARTS (check all that apply)

☒	Specification	Number of Pages	23	☒	Small Entity Statement
☒	Drawing(s)	Number of Sheets	2	☒	Other (specify) Assignment with Recordation Coversheet

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT (check one)

		FILING FEE AMOUNT
☐	A check or money order is enclosed to cover the filing fees	
☒	The Commissioner is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number: 03-3419	$75.00

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are: _____

Respectfully submitted,

SIGNATURE _____ Date 01/08/1999

TYPED or PRINTED NAME Maier FENSTER REGISTRATION NO. (if appropriate) 41,016

TELEPHONE (212) 790-9200

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

SEND TO: Box Provisional Application, Assistant Commissioner for Patents, Washington, DC 20231

P19SMALL/REV04

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) AND 1.27 (c)) - SMALL BUSINESS CONCERN	Docket No. 100/00798

Serial No.	Filing Date	Patent No.	Issue Date
	HEREWITH		

Applicant/
Patentee: Alon ATSMON

Invention:
COMPUTER COMMUNICATION

I hereby declare that I am:

- ☐ the owner of the small business concern identified below:
- ☒ an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN: COMSENSE TECHNOLOGIES, LTD.
ADDRESS OF CONCERN: 35 JABOTINSKY STREET, TWIN TOWERS 2, RAMAT-GAN 52511

I hereby declare that the above-identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under Section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the above identified invention described in:

- ☒ the specification filed herewith with title as listed above.
- ☐ the application identified above.
- ☐ the patent identified above.

If the rights held by the above-identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed on the next page and no rights to the invention are held by any person, other than the inventor, who could not qualify as an independent inventor under 37 CFR 1.9(c) or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

☒ no such person, concern or organization exists.
☐ each such person concern or organization is listed below.

FULL NAME _____
ADDRESS _____
☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

FULL NAME _____
ADDRESS _____
☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

FULL NAME _____
ADDRESS _____
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ADDRESS _____
☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING: Alon ATSMON
TITLE OF PERSON SIGNING OTHER THAN OWNER: GENERAL MANAGER
ADDRESS OF PERSON SIGNING: 131/2 BEN-GURION STREET, YEHUD 56109, ISRAEL

SIGNATURE: _____ DATE: 8/1/99

COMPUTER COMMUNICATION

FIELD OF INVENTION

The present invention relates generally to electronic devices that communicate among themselves using acoustic transmissions.

BACKGROUND OF THE INVENTION

Computer network components which communicate using RF radiation , wires or IR radiation are well known. In addition, some home appliances are controlled using an ultrasonic remote control.

However, such dedicated communication mechanisms require that the computer network components have installed thereon specialized communication hardware. Installing such hardware on an existing computer may be expensive and/or problematic. Further, some electronic and/or computer embedded devices, for example cellular telephones may be "sealed" products, to which it is impossible to add internal components.

SUMMARY OF THE INVENTION

One object of some preferred embodiments of the invention is to simplify interaction between electronic devices by removing a common requirement of installing dedicated communication hardware on these devices. Some suitable electronic devices include: computers, televisions, watches, PDAs, organizers, electronic toys, electronic games, voice-responsive appliances, wireless communication devices, answering machines and desktop telephones. As used herein the term "electronic device" is used to encompass a broad range of electronics-including objects. However, in some cases, a particular type of electronic device is singled out, for example a computer or a toy. It is noted that some of the below-described embodiments are more useful for some type of electronic device than for other types of electronic devices.

An object of some preferred embodiments of the invention is allowing electronic devices to communicate using an input and/or output channel, preferably an acoustic channel, but possibly a visual channel, which was deigned for communication with human users and not with electronic devices.

An aspect of some preferred embodiments of the invention relates to communication between electronic devices using sounds. Alternatively or additionally to communications using RF; varying magnetic fields, preferably low frequency; IR; and visible light, electronic devices may communicate using acoustics. In a preferred embodiment of the invention, the sounds used for communications are incorporated in sounds used for regular operation of the device, for example by modulating beeps. Alternatively or additionally, the sounds are inaudible, for example being ultrasonic, infrasonic, of a low amplitude and/or having only

small changes in amplitude.

It is noted that many electronic devices include a microphone and/or a speaker. In a preferred embodiment of the invention, the microphone and/or speaker are used to communicate with the device. In one example, an acoustic smart card (or an "electronic wallet" card) communicates with such a device using sound and/or ultrasound. Such a smart card may transmit information stored thereon. Possibly, the information is encrypted, for example, using RSA encryption.

In a preferred embodiment of the invention, a smart card may be "swiped" at practically any existing computer and many existing electronic devices, possibly requiring a simple software installation. Such simple swiping should ease acceptance of the card by Internet browsing home shoppers. In some cases, the swiping software may be downloaded as a Java Applet.

Alternatively or additionally, two electronic devices can communicate, for example a cellular telephone and a PDA, each of which includes a microphone and a speaker, for example for programming the cellular telephone with the names and numbers stored in the PDA or for the cellular phone to interrogate the PDA regarding a particular telephone number. Alternatively or additionally, network may be formed of a plurality of such devices, possibly, with one device forwarding messages from a first device to a second device. Alternatively or additionally, peripherals may be connected to a computer using an acoustic connection, without requiring wiring or special hardware. In some embodiments, a single acoustic transducer (microphone or speaker) may be controllable to act as both a receiver and a transmitter, by suitably programming the electronic device.

In the example of a computer, many computers are sold with a Sound-Blaster Compatible sound subsystem, stereo speakers and a microphone. Typically, this sound system is designed for generating music and other audible sounds. In addition, may computers include an internal speaker and a modem speaker.

It should be appreciated that in some embodiments of the invention the sound communication is directed at the device and not for passing through the device. Thus, in the example of a telephone, computer-information encoding signals may be interpreted by the telephone and are not meant just to be transmitted on through the computer network.

An aspect of some preferred embodiments of the invention relates to interfacing a toy and/or other device with a computer system without installing hardware on the computer. In one example, using a computer having installed thereon a sound card with a microphone and/or loudspeakers, the loudspeakers are used to interrogate an identification device, using ultrasound. In another example, such interrogation is used to determine distance from and/or

location of a toy. Preferably, the computer's microphone is used to detect a response from the interrogated device. In some embodiments, especially for toys, the interrogation may comprise audible sounds. Thus, in a preferred embodiment of the invention, cheap and/or simple communication between a toy and another toy or a computer is feasible. Also, it becomes simpler to connect a play implement to a computer game which responds to that play implement.

In a preferred embodiment of the invention, the acoustic waves used for communication or possibly dedicated acoustic waves may be used to determine the relative position and/or orientation of electronic devices. In a preferred embodiment of the invention, a touch screen is emulated by interrogating a transponder on a pointing implement, using built-in speakers of an electronic device, to detect to position, orientation and/or motion of the implement.

An aspect of some preferred embodiments of the invention relates to inactivating a stolen electronic device. In a preferred embodiment of the invention, the electronic device interrogates an acoustic transponder using the device's built-in speaker and/or microphone. If the transponder does not respond (e.g., the device was stolen and separated from the transponder), the device does not work and/or if possible, transmits a message to an enforcement authority or to the owner, for example by computer network (e.g., for a laptop computer) or by wireless communication (e.g., for a cellular telephone).

An aspect of some preferred embodiments of the invention relates to authorization and authentication over an Internet or another type of communication network, using sound. Preferably, the communication pathway is not required to change, except that the two ends of the pathway may require hardware or software for manipulating sound signals. In one example, a smart-card transmits an encoded acoustic signal to a computer. that signal is transmitted over the Internet to a remote server computer, to serve as authorization for debiting an account. In the opposite direction, a coded signal may be provided from a toy program depository, to be downloaded using acoustic waves to a toy which is nearby the computer. Such a coded signal may, of course, also be used to download information to a smart card.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be more clearly understood with reference to the following detailed descriptions of non-limiting preferred embodiments of the invention in which:

Fig. 1 is a schematic illustration of a computer and an electronic device which are operative to communicate using sound waves, in accordance with a preferred embodiment of the invention;

Fig. 2 is a schematic illustration of two communicating electronic devices, in accordance with a preferred embodiment of the invention;

Fig. 3 is a schematic illustration of a smart card communicating with a computer, in accordance with a preferred embodiment of the invention;

Fig. 4 is a schematic illustration of an Internet transmission pathway for sounds, in accordance with a preferred embodiment of the invention; and

Fig. 5 is a schematic illustration of a method of tapping into a computer, without requiring complicated installation of hardware, in accordance with a preferred embodiment of the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Fig. 1 is a schematic illustration of a computer 20 and an electronic device 30, which are operative to communicate using sound waves, in accordance with a preferred embodiment of the invention. Most computers currently on sale include a sound system 24, usually a sound card, connected to at least one microphone 26 and at least speaker 28. Many electronic devices include a microphone 34 and a speaker 36. In a preferred embodiment of the invention, computer 20 and electronic device 30 communicate using these standard features, which are usually not designed for computer communication but for human communication. In some cases, the electronic device (or the computer) may include a jack to which one or more speakers and one or more microphones may be connected. Preferably, such connected acoustic elements are positioned on a hard to obstruct portion of the device, preferably at positions where they have a wide field of view.

In one preferred embodiment of the invention, a standard card, such as the popular "Sound-Blaster" is used to generate sonic and/or ultrasonic signals to (and receive from) an electronic device, a toy and/or another object. The acoustic signal may be audible or inaudible, for example being ultrasonic or infrasonic. Preferably, frequencies of about 20kHz and 44kHz are used, since a standard sound card provides these sampling rates.

In some cases, the microphone and/or the sound card are sensitive enough to receive from the object RF signal associated with generating the acoustic signals, even if an acoustic signal is not sent.

In a preferred embodiment of the invention, such an acoustic communication may be used to program a toy and/or retrieve information from a toy, for example replacing an RF link as described in US patent number 5,752,880, the disclosure of which is incorporated herein by reference. Alternatively or additionally, such a link may be used for real-time communication with the toy.

Some embodiments of the invention do not require that the electronic device communicate with a computer. Fig. 2 is a schematic illustration of two communicating electronic devices 30 and 30'. In one example a PDA communicates with a printer. In another, an organizer communicates with a satellite telephone. Possibly, such communication is used to exchange data files and/or to share capabilities, such as modem connections. In some cases an adapter, for example sonic to parallel may be required.

A computer network in accordance with a preferred embodiment of the invention utilizes sound waves transmitted between computers, using existing hardware, for example an audio card, loudspeakers and a microphone. Preferably, the sound waves are ultrasound waves. In a preferred embodiment of the invention, such a computer network is used to connect a PDA or a portable computer to a different computer, for example for data transfer to or for sharing peripherals, such as a modem, a printer or a storage device. Thus, an existing PDA (which includes a loudspeaker and a microphone) can utilize a modem of a desk-top computer, without requiring additional hardware in the PDA, possibly requiring only a small software change. Alternatively or additionally, such a network may be used in a small office, for example for file or printer sharing.

In a preferred embodiment of the invention, sonic and/or ultrasonic communication is used for paying a toll (human, package or vehicle), utilizing a reactive component, possibly a passive transponder, on the tolled item. Alternatively or additionally, an acoustic mechanism is used to open vehicle barriers, for example at entrances to apartment complexes or to open garage doors. Alternatively or additionally, the acoustic mechanism is used for automatic refueling systems, possibly transmitting billing and/or mileage information to a pump receiver. Possibly, the car horn, an alarm speaker, a car radio speaker or a dedicated speaker, is used to sound the required sonic and/or ultrasonic signals.

Alternatively or additionally, to using a computer, in a preferred embodiment of the invention, a set-top box is used to transmit and/or receive acoustic signals. Preferably, a microphone is connected to the set-top box. Alternatively or additionally, the transmission back to the set-top box uses an IR signal, which is detectable by the set-top box. In one example, the set-top box includes software which analyses signals. Such signals may comprise responses of electronic devices and/or toys to sounds generated by the television or by the set-top box. Alternatively or additionally, the set-top box adds sounds (or ultrasonic waves) to a video and/or audio stream decompressed by the sound box. Alternatively or additionally, the set-top box adds temporal and/or spatial optical modulations to a video stream, for an optically-sensitive electronic device to detect.

In a preferred embodiment of the invention, the detection of a signal by an electronic device (or a computer) comprises a binary detection of the signal, e.g., an on/off state. Additionally or alternatively, more complex signal detection may be implemented, for example, detection of signal amplitude, frequency, frequency spectrum, Doppler shift, change in amplitude and/or duration, detection of a number of repetitions, voice and/or other pattern recognition in the sound, detecting patters of motion, for example gestures and/or detection of codes, for example in a flashing light source. The transmitted signal may include one or more of information about the sending device's activities, location, environment, nearby devices, locally sensed information, logic state, readiness, requests for information and/or answers to such requests.

Such signal detection and/or analysis may also be performed on a computer which is in communication with the electronic device. The physical detection circuit is preferably located on the toy. Additionally or alternatively, the detection circuit is also located on the computer.

In a preferred embodiment of the invention, microphone 34 (or microphone 26) comprises a directional microphone, for example a stereophonic microphone or a microphone in which the frequency response is spatially non-uniform.

PCT application PCT/IL98/00450, titled "The Control of Toys and Devices by Sounds", filed September 16, 1998, in the Israeli receiving office, the disclosure of which is incorporated herein by reference, describes sound actuated toys. In particular, the application describes various sound makers which generate sounds inadvertently as a result of motion, for example beads in a box or crinkle material. In a preferred embodiment of the invention, such a sound maker is connected to and/or mounted on toy 20, so that when toy 20 moves a signal will be generated for toy 22. This PCT application also describes detecting the direction and/or position of a sound, using directional microphones and/or a stereophonic microphone including two or more microphone elements. Additionally or alternatively, a relative distance is determined based on an amplitude of the sound.

Israel application 127,569, filed December 14, 1998, titled "Interactive Toys", the disclosure of which is incorporated herein by reference, describes various toys and electronic devices which interact using sound waves.

Fig. 3 is a schematic illustration of a smart card 40 which communicates with a computer. Although a smart card is a special case of an electronic device it is noted that typical smart cards do not include an acoustic input/output channels, especially not an ultrasonic one.

In a preferred embodiment of the invention, smart card 40 comprises an acoustic element 42, a processor 44 which controls the acoustic element and a memory 46 for storing information. Such a smart card may utilize a single piezoelectric transducer (possibly a film)

for both transmission and reception. In a preferred embodiment of the invention, the received signals from element 42 are amplified to TTL levels and connected directly into one or more data lines of the micro-controller, for analysis. Thus, a high acoustic frequency can be detected and/or analyzed, without requiring an A/D. Preferably, the signal is amplified by various amounts, such as multiples of two of each other and connected in parallel to a plurality of data legs, so that multi-level signal detection is facilitated. As many electronic devices include a speaker and/or a microphone, such a card may communicate with any such device which has suitable software. Due to the decreasing size of electronics, in some cases, a smart card may be emulated using a PDA, both with regard to size and with regard to functionality.

In another example, a smart card is used to operate arcade games. Such a card may utilize the speaker and/or microphone of the game. Alternatively or additionally, the card may include information about the user, for example for billing. Alternatively or additionally, the information may include gaming information, for example how far in the game the player is or player level, so the arcade game can be suitably configured.

It should be noted that such an acoustic smart card may also be used as a customer card, as well as for an "electronic wallet", since information about the card holder can easily be retrieved from the card. Also, it is simple to transmit information to the card.

In a preferred embodiment of the invention, spatial angles between a sound source and a plurality of microphones are determined by analyzing phase differences at the microphones. Alternatively or additionally, other methods known in the art may be used. In a preferred embodiment of the invention, a relative location of a pulsing sound source and a plurality of microphones is determined by solving time of flight equations. Thus, the relative location of a smart card, an ID card (described below), an electronic device and/or a computer, relative to another electronic device, may be determined and used to control the operation and/or cooperation of one of the above electronic devices.

In a preferred embodiment of the invention, four microphones are used to determine a three-dimensional position. For a source at $r=(x_0,y_0,z_0)$ and a plurality "i" of microphones at $M_j=(x_i,y_i,z_i)$, the distances between the source and the microphones are $D_i=\|r-M_i\|$. The acoustic velocity, "c", may be known, for example based on a known velocity in air. Alternatively, it may be determined by measuring the time of flight between a sound source and a microphone having fixed and known relative locations. A difference between distances is preferably defined as $dD(i,j)=Di-Dj=c*dt(i,j)$, where $dt(i,j)$ is defined as a difference between time of arrival at microphone i and time of arrival at microphone j. For N microphones there are N-1 independent differences dD. In an optimal configuration, the four microphones located at vertexes of a tetrahedron may be used to determine the location of a

source. From practical considerations, such an arrangement may not be possible. Preferably, more than four microphones are used, so that a higher resistance to noise and/or a higher localization precision may be achieved. In a preferred embodiment of the invention, the three dimensional position is determined by numerically or analytically solving three equations of the form:

$dD=c*dt(i,j)=\|r-M_i\|-\|r-M_j\|$, where (i,j) is preferably selected to be (1,2), (2,3) and (3,4). However any other independent three pairs of microphones may be used. In some cases it is useful if one of the electronic devices operates as a transponder, which receives signals and sends back a signal indicative of the received signal and/or its time of flight.

A touch screen in accordance with a preferred embodiment of the invention utilizes acoustic transmission to detect the location of a touch implement, such as a pen. In a preferred embodiment of the invention, the position of the pen is determined using one or more microphones and/or speakers mounted on the pen, which transmit and/or receive signals from a computer and/or other speaker and/or microphone controller. Possibly, a three-dimensional position of the touch implement is determined using four acoustic elements, such as two microphones and two speakers. It is noted that a computer typically includes a modem speaker, an internal speaker and/or a keyboard speaker, as well as sound-card speakers.

In a preferred embodiment of the invention, location methods utilize a calibration process, in which the located implement is placed at one or more known location, so that it is possible to correct for the location of the speaker(s) and the microphone(s)/ Alternatively or additionally, the calibration procedure is used to correct for propagation times (of the acoustic waves and/or of electronic signals which generate sounds) and/or for reflections, wavelength dependent attenuation and/or broadband attenuation.

A different type of touch screen in accordance with a preferred embodiment of the invention detects the location of a touch implement based on the detection and position determination (2D or 3D) of sounds generated when the touch implement touches the "touch sensitive" surface.

A software protection method in accordance with a preferred embodiment of the invention comprises a passive ID tag which responds to an interrogation. In one example, such a tag is attached to the case of a software CD, such that the software will operate only if the computer on which it runs can interrogation the CD for a particular code, using ultrasonic or sonic signals. Alternatively or additionally, the ID tag may be attached to the CD itself and/or attached to (or integrated with) an implement used for interacting with the software, for example a toy implement. Alternatively or additionally, the tag may be permanently attached (such that removal will damage it) to the case and/or monitor and/or other internal or external

element of the computer. Alternatively to protecting software, such a method may be used to protect an easily stolen device, such as a PDA or a laptop computer, which can use their internal speakers and/or microphones to detect the proximity of a required ID tag.

An authentication system in accordance with a preferred embodiment of the invention preferably uses a computer for authentication. In a preferred embodiment of the invention, a user may be authenticated by the computer dialing a user's personal communicator (for example a beeper, a cellular telephone, wireless telephone or a satellite telephone) and then listening for a ring of the personal communicator. Preferably, the personal communicator is programmed for a distinctive ring, at least for calls originating from the computer. Alternatively or additionally, a cellular network may instruct a cellular telephone to generate a certain sound, responsive to a request (possibly by computer network) from the computer.

Alternatively or additionally, a user calls up the computer (or the computer calls the user) and the computer performs authentication by transmitting a certain sound to the personal communicator and listening for that sound using its room microphone. Preferably, the sounds are sonic. Alternatively or additionally, the sounds are ultrasonic, for example 20kHz or above. In a preferred embodiment of the invention, the computer uses the detected sound to determine attributes of the personal communicator, for example its distance from the computer.

Alternatively or additionally to providing a telephone connection, a personal communicator may respond to an ambient room sound (for example an ultrasonic wave or a DTMF tone from a computer) with an ID code. Alternatively or additionally, a user may enter a code into a computer by dialing the code on his personal communicator and allowing the computer to receive the DTMF tones using the computers microphone.

Alternatively or additionally, to a personal communicator, an interrogated ID tag may be used. In some embodiments of the invention, such a tag is interrogated directly using RF, in others, using sound and/or ultrasound (depending on the tag construction). Preferably, the tag responds with acoustic signals, possibly ultrasonic. Optionally, the tag uses the energy of the interrogation signal to generate the response signal. Alternatively or additionally, the tag is interrogated using a tag-specific code. In a preferred embodiment of the invention, such a tag is used for computer log-on authentication, for example, when a wearer approaches a computer, the computer automatically logs on to that user. Alternatively or additionally, the computer may require the proximity of the ID card in addition to standard log-on procedures. Alternatively or additionally, the computer may periodically interrogate the ID card, to insure that the card wearer is still nearby. Alternatively or additionally, the computer may interrogate the card for user specific information, for example voice ID or personal information. The computer can thus query the user for a voice response and compare the response (voice print

and/or contents) to confirm the card wearer is a designated card wearer. A user can wear two cards, one for general authorization and one including personal information. Thus, a computer may interrogate both cards.

In a preferred embodiment of the invention, an interrogated object receives the ultrasound signal and sends it back to a microphone of the computer. In a preferred embodiment of the invention, the computer analyses the time of flight and/or other attributes of the transmission and determines a distance from, position to, velocity of motion and/or other spatial attributes of the object.

In a preferred embodiment of the invention, the object responds immediately to the interrogation signal. Alternatively, the object delays its response to an interrogation signal, for example for a few milliseconds. Alternatively or additionally, the object transmits at a different frequency, for example 40kHz. Alternatively or additionally, the signal transmitted by the object is received by a transducer which then transmits the signal to the computer, for example acoustically or using electromagnetic coupling. Alternatively or additionally, the object may respond with an identification code. Alternatively or additionally, the object modulates its transmission with an envelope, which envelope preferable servers as an identification code and/or for transmission of information regarding a status of the object, for example a position of an arm of a toy. In some cases, the object relays information from a more remote object. In the case of identification, the object may send an ID code even without prompting from the computer, for example periodically or by a user pressing a button on the object.

In a preferred embodiment of the invention, the object amplifies the signal it receives using a discharge of a coil through a transistor, where the transistor serves as a variable resistor and/or as a wave-form controller.

Fig. 4 is a schematic illustration of an Internet transmission pathway for sounds, in accordance with a preferred embodiment of the invention. When a smart card 40 (or interrogated badge) transmits information carrying sounds to a computer, these sounds may be analyzed on the computer. Alternatively or additionally, the sounds may be transmitted from the computer to a remote computer, where they are analyzed. In a preferred embodiment of the invention, a local client computer 62 receives sounds and transmits them over an Internet 60 to a server computer 50. Alternatively to using an Internet, an Intranet, a LAN, a Wan or another type of computer data network is used. it is noted that there exist standard protocols for transmitting sounds over networks. Thus, there is little or no need for changes in the hardware and/or software configurations of the communication pathway, especially not of client 62. The pathway can also work in the other direction, for example, when a toy downloads

programming from a remote server and the programming is stored as a toy-understandable sound file, or when the server interrogates the smart card. It is noted that playing of sound is also supported by standard Internet protocols. Alternatively or additionally, a smart card may serve as an interrogated ID tag which is used to control access to and/or billing of usage an Internet site. In one example, whenever a user requests a service from the Internet, the existence of a local smart card is ascertained. Billing information is preferably transmitted to the card. Periodically, the card is interrogated (possibly by a third party), preferably over the Internet or a telephone connection, for the existence of charges.

In an example of a financial or business interaction over an Internet, one or more of the following three levels of security may be achieved. First, the presence of the card. Second, confirmation of the card wearer using personal information. Third, an identification of the calling computer (which should preferably match the wearer profile and/or information stored on the card). Additionally, it is noted that there exist standard mechanisms for transmitting sound over an Internet, LAN, WAN or a telephone line. Thus, sonic or ultrasonic communication, for example from a smart card or an ID card may be practiced over a telephone connection or over an Internet connection. These communications may include coded communications, for example using the RSA encoding or other public-key algorithms. Alternatively or additionally, the communications may use DTMF tones. Alternatively or additionally, such communications may be used for telephone calling cards. Alternatively or additionally, such communication may be used for transmitting credit card information. In a preferred embodiment of the invention, a credit card includes a sound output (optionally encoded). Thus, a user can "swipe" his card at any electronic device which includes a microphone (optionally a speaker, for two way communication) and suitable software/hardware, for example a home computer. Possibly, swiping software may be downloaded as a Java applet.

Fig. 5 is a schematic block diagram of a communications tap 102 for a computer 100, in accordance with a preferred embodiment of the invention. One problem with computer communication is setting up the hardware and software for communications. In the configuration of Fig. 6, a tap is preferably placed on communication line to an existing peripheral 104. Thus, a user may not be required to even access a back part of a computer, let alone a computer's inside. A toy 106 or an electronic device preferably sends and/or receives signals from tap 102. Additionally or alternatively, toy 106 may use one tap for receiving and one for sending.

In a preferred embodiment of the invention, the tap is placed on a cable to a printer, a network cable, a camera cable and/or a SCSI connection. Additionally or alternatively, the tap

is placed on a serial cable, for example a mouse cable. Additionally or alternatively, the tap is placed on a modem line, for example on a telephone line or by plugging the tap into another telephone socket, to be received by the modem. Additionally or alternatively, the tap is placed on a game controller line. Additionally or alternatively, the tap is placed on a loudspeaker line. Additionally or alternatively, the tap is placed on a microphone line. Additionally or alternatively, the tap is placed on a display cable line.

In a preferred embodiment of the invention, the tap includes an electro-magnetic coupler, which can induce signals in a cable which passes through or near the tap. Additionally or alternatively, the tap can detect signals in the line and transmit them to toy 106. In a preferred embodiment of the invention, the signals are at a different carrier frequency and/or signal frequency than the usual signals passed along the line. Additionally or alternatively, the signals travel in an opposite direction (input signals on an output line, such as a printer or output signals on an input line, such as a mouse). Additionally or alternatively, the signals encode data which is detected and removed from the data stream in the computer. Additionally or alternatively, the signals are asynchronic on a synchronic line. Additionally or alternatively, the signals are transmitted only when no signal is expected by the computer and/or the peripheral.

In an alternative embodiment of the invention, a piezoelectric actuator (or other vibrating element) is connected to a mouse. The actuator causes the mouse to shake at an amplitude of one or two screen pixels (or less) and the shaking is detected by software in the computer as signals from the toy. A return signal may be transmitted to a tap associated with the actuator, along the serial cable, with the signal preferably being coded to be recognized by the tap and/or ignored by the mouse.

In an alternative embodiment of the invention, toy 106 communicates with computer 100 using a speaker and a microphone of the computer. Preferably, toy 106 receives transmissions from the computer loudspeaker and/or sends signals to the computer microphone. Additionally or alternatively, signals are transmitted to toy 106 via the microphone and received via the loudspeaker, depending on whether the hardware supports such a reverse connection.

In an alternative embodiment of the invention, toy 106 sends signals to computer 102 using a tap which presses keys on a keyboard attached to computer 100. Preferably the key sued is a shift key. Additionally or alternatively, signals from the computer are detected by detecting illumination of LEDs on the keyboard, for example a "Num Lock" LED.

Additionally or alternatively, toy 106 utilizes a transducer which plugs into a parallel port, a serial port and/or is optically coupled or placed near an IR port. Preferably, the

transducer is a pass through transducer, through which a printer and/or other peripherals may communicate normally with a computer.

In a preferred embodiment of the invention, the tap and/or transducer can automatically detect which type of cable is tapped/port is connected to. Preferably, such detection is by analyzing amplitude, frequency and/or synchronization of signals passing through the lines. Additionally or alternatively, the computer detects which line is tapped, by detecting particular inferences on that line. Alternatively or additionally, software on the computer sends test signals along the lines, to be detected by the tap.

In a preferred embodiment of the invention, suitable software is installed on computer 100. Preferably, the software is self installing. Preferably, the computer is not used for any other use while toy 106 is communicating with it. Additionally or alternatively, the software can differentiate between "regular" signals" and signals related to the tap. In one example, a provided keyboard driver may detected special codes and/or data sequences on the keyboard line and remove them from the received data, passing only the rest of the received data to an operating system of computer 100. Additionally or alternatively, a provided mouse driver may detect spurious and/or small mouse movements, and recognize them as being tap related signals. Additionally or alternatively, a printer driver can recognize data on the cable as not coming from the printer but from a tap. Additionally or alternatively, data sent to the tap is preferably sent as data which will be rejected or ignored by the peripheral. Alternatively or additionally, to using a tap for communication with a toy, such a tap may be used to attach a peripheral to computer 100.

In a preferred embodiment of the invention, the signal received on the computer is used to modify a computer game and/or to generate commands to other toys, preferably using sounds generated by the computer. Thus, a computer game in which a computer display responds to external sounds, is preferably provided.

The acoustic communication may also be used to communicate between a play implement and a computer game, for example between a sword and a play station. In one example, a light-pen or a light-gun transmits to the playstation a signal responsive to pixel intensities which are detected by a photo-detector thereon. Alternatively or additionally, a synchronization signal is transmitted from a computer and/or a set-top box to the pen, to synchronize the pixel detection with the TV raster scan. These transmissions may be additional to- or alternative to- transmission of position and/or orientation. Alternatively or additionally, the play implement transmits the status of controls thereon. Alternatively or additionally, the transmission is used to transmit information to be displayed on the implement, for example to light up lights thereon, display a number of kills thereon and/or drive text and/or graphics

displays thereon.

In a preferred embodiment of the invention, a bowling game is provided, in which a computer detects sounds generated by a moving bowling ball and knocks over pins on a display. Preferably, a soft ball is used. preferably, the motion of the ball is determined relative to the computer microphone and/or speakers, as described herein. Alternatively, an independent sound generator and/or receiver may be utilized, which sound element is preferably integrated with a computer using minimally-installed hardware, as described herein.

In another example, a computer displays a thrown ball, for example a baseball and determines a "hit" based on detected motion of a baseball bat. In another example, a computer goalie attempts to stop a real ball kicked by a player. The position and/or other motion attributes of the ball are preferably determined by acoustic distance determination using only the hardware already installed in a standard computer, for example as described herein. In another example, a boxing match a computer tracks motion of a glove, to detect hits on a computer figure and/or to emulate evasive maneuvers. Alternatively or additionally, the computer tracks motion of the player, to aim its own punches and/or to asses a score. Optionally, the computer is used to display motion of a second remote player. Alternatively or additionally to boxing, the computer may track motion of sources (preferably with implanted sound devices or with a wrist band sound device). Alternatively or additionally, the computer may track positions and/or alignments of toy guns and/or of players holding the guns. Possibly a map of a room may be provided so the computer can determine if a gun has a line of site in the particular room.

In a preferred embodiment of the invention, the signals generated by a toy are inadvertently generated, for example, sounds generated by a wheel rotating or an appendage flapping. Additionally or alternatively, the signals are included in a generated action, for example, a quack sounded by a toy, which may be modulated by a signal, a blinking light, whose blinking may be modified by the signal or a waving gesture which may be modified and/or its duration or amplitude changed, to convey a signal. Additionally or alternatively, the signals are determined by analyzing a response, for example differentiating between different sounds produced by a first toy to decide which sound to make in response. Additionally or alternatively, the signal may be additional to generated actions, for example, an extra beep after a "quack". Preferably, such additional signals are made as unobtrusive as possible, for example by being ultrasonic.

In another example, a computer and/or a toy can respond to DTMF tones generated by a telephone handset, a wireless telephone, a cellular telephone or even a play telephone.

The present invention has been described in terms of preferred, non-limiting embodiments thereof. It should be understood that features described with respect to one embodiment may be used with other embodiments and that not all embodiments of the invention have all of the features shown in a particular figure. In particular, the scope of the invention is not defined by the preferred embodiments but by the following claims. Section titles, where they appear are not to be construed in limiting subject matter described therein, rather section titles are meant only as an aid in browsing this specification. When used in the following claims, the terms "comprises", "comprising", "includes", "including" or the like means "including but not limited to".

CLAIMS

1. A method of communicating with an electronic device, comprising:

providing an electronic device having:

a sound receiving and generating sub-system comprising a microphone; and

transmitting at least one sound to the device, which sound encodes information; and

receiving said at least one sound by said microphone.

2. A method according to claim 1, comprising processing said at least one sound by said electronic device.

~~3. A method according to claim 2, wherein processing comprises extracting said encoded~~ information.

4. A method according to claim 2 or claim 3, wherein said at least one sound is transmitted from a location.

5. A method according to claim 4, wherein said processing comprises determining a distance between said microphone and said location.

6. A method according to claim 4, wherein said processing comprises determining movement of said microphone relative to said location.

7. A method according to claim 6, wherein said movement comprise angular movement.

8. A method according to claim 6 or claim 7, wherein said movement comprise translation.

9. A method according to claim 4, wherein said processing comprises determining a spatial position of said microphone relative to said location.

10. A method according to claim 9, wherein said spatial position is a one-dimensional spatial position.

11. A method according to claim 9, wherein said spatial position is a two-dimensional spatial position.

12. A method according to claim 9, wherein said spatial position is a three-dimensional spatial position.

13. A method according to any of claims 4-12, wherein said processing comprises emulating a touch screen using said received at least one sound.

14. A method according to any of claims 4-12, wherein said processing comprises emulating a pointing device using said received at least one sound.

15. A method according to any of claims 4-12, comprising controlling at least one action of a toy, responsive to said received at least one sound.

16. A method according to any of claims 1-15, wherein said electronic device comprises a wireless communication device.

17. A method according to any of claims 1-15, wherein said electronic device comprises a computer.

18. A method according to any of claims 1-15, wherein said electronic device comprises a computer peripheral.

19. A method according to claim 18, wherein said peripheral comprises a printer.

20. A method according to any of claims 1-15, wherein said device comprises a PDA (personal data assistant).

21. A method according to any of claims 1-15, wherein said device comprises a toy.

22. A method according to claim 21, wherein said information comprises programming information.

23. A method according to any of claims 1-22, wherein transmitting comprises transmitting from a toy.

24. A method according to claim 23, wherein said information comprises stored player input.

25. A method according to any of claims 1-22, wherein said transmitting comprises transmitting said at least one sound by a smart card.

26. A method according to any of claims 1-22, wherein said transmitting comprises transmitting said at least one sound by a wireless communication device.

27. A method according to any of claims 1-26, comprising performing a financial transaction responsive to said at least one received sound.

28. A method according to any of claims 1-27, comprising identifying a person responsive to said at least one received sound.

29. A method according to any of claims 1-28, wherein said information comprises personal information.

30. A method according to any of claims 1-29, comprising logging into a computer system responsive to said at least one received sound.

31. A method according to any of claims 1-30, comprising transmitting said at least one received sound over an Internet.

32. A method according to any of claims 1-31, wherein said sound subsystem comprises a speaker and comprising transmitting acoustically encoded information from said speaker.

33. A method according to claim 32, wherein said transmitting at least one sound comprises transmitting said at least one sound responsive to said information transmitted from said speaker.

34. A method according to claim 32 or claim 33, wherein said transmitting acoustically encoded information comprises transmitting acoustically encoded information responsive to said received at least one sound.

35. A method according to any of claims 1-34, wherein said sound comprises human audible sound.

36. A method according to claim 35, wherein said sound has a main frequency over 10kHz.

37. A method according to any of claims 1-34, wherein said sound is inaudible.

38. A method according to claim 37, wherein said sound has a main frequency which is ultrasonic.

39. A method according to claim 37, wherein said sound has a main frequency which is infra-sonic.

40. A method according to claim 37, wherein said sound has a below human-threshold amplitude.

41. A method according to claim 37, wherein said sound has below human-threshold amplitude variations.

42. A method according to any of claims 35-41, wherein said sound is generated at a frequency outside a normal operating frequency for said sound subsystem.

43. A method according to any of claims 1-42, wherein said sound subsystem is designed for generating musical sounds.

44. A method according to any of claims 1-42, wherein said sound subsystem comprises a sound card.

45. A method according to claim 44, wherein said sound card comprises a sound-Blaster compatible sound card.

46. A method according to any of claims 1-45, wherein said sound sub-system is designed for communication with a human operator.

47. A method of performing a transaction over an Internet, comprising:

transmitting information encoding sound over the Internet from a client computer to a server computer;

analyzing said information at said server computer; and

performing a transaction at said server computer responsive to said analysis.

48. A method according to claim 47, wherein comprising inputting said sound to said client computer using a microphone of said client computer.

49. A method according to claim 47 or claim 48, wherein said transaction comprises a financial transaction.

50. A method according to any of claims 47-49, wherein said information comprises authentication information.

51. A method according to any of claims 47-50, comprising receiving said sounds using a microphone attached to said client computer.

52. A method of creating a smart card terminal, comprising:

providing a general purpose computer having a general-purpose sound sub-system; and

loading a smart-card terminal software on said computer,

wherein said software controls said sound system to receive sounds from a smart card.

53. A method according to claim 52, wherein said software analyses said received sounds to determine information encoded by said sound.

54. A method according to claim 52, wherein said software retransmits said sounds to a remote computer which analyses said received sounds to determine information encoded by said sound.

55. A method according to any of claims 52-54, wherein loading a smart-card terminal software comprises downloading the software over an Internet.

56. A smart card comprising:

a memory;

a processor; and

an ultrasonic transmitter which transmits signals generated by said processor responsive to information stored in said memory.

57. A smart card comprising:

a memory;

a processor, which generates an encrypted information signal responsive to information stored in said memory; and

an acoustic transmitter which transmits said signals generated by said processor.

58. A smart card according to claim 56, comprising a receiver which receives ultrasonic signals, wherein said processor processes said received signals and stores information in said memory responsive to said processing.

59. A computer system comprises:

a processor;

a sound sub-system comprising:

a speaker which generates sounds; and

a microphone which receives sounds;

a memory; and

a software installed in said memory, wherein said software analyses sounds received by said microphone to recognize information encoded by said sounds and wherein said software uses said speaker to transmit information encoding sounds responsive to said recognized information.

60. A method of Internet authentication, comprising,

transmitting, over an Internet, authentication information encoded by sound, from a client computer to a server computer;

61. A method of attaching a peripheral to a computer, comprising:

providing a general purpose computer including a sound generating and receiving subsystem;

analyzing received sounds to detect acoustic transmissions from said peripheral; and

transmitting information to said peripheral using encoded sound transmissions.

ABSTRACT OF THE INVENTION

Communication between electronic devices using sonic or ultrasonic waves without requiring the installation of dedicated communication hardware in the devices, but by using existing speakers and/or microphones which are usually included for communication with a human user.

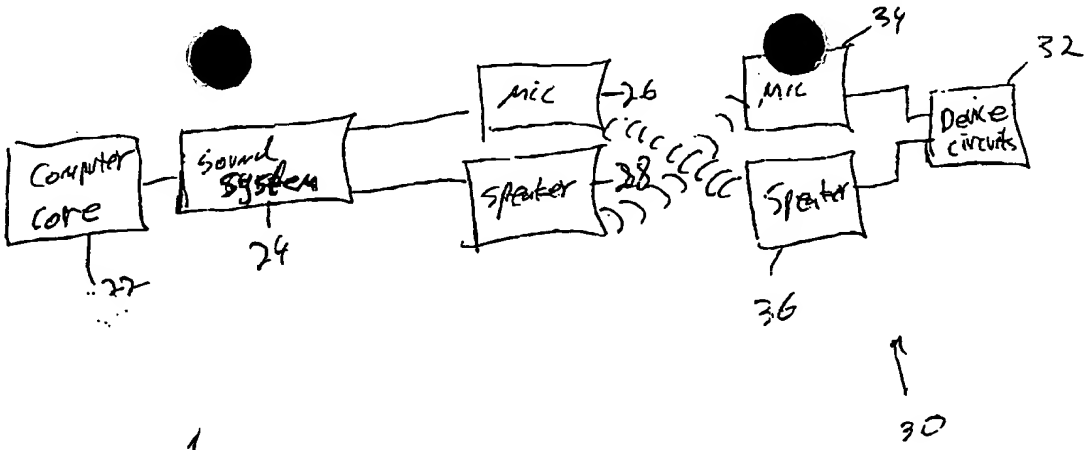

Fig 1

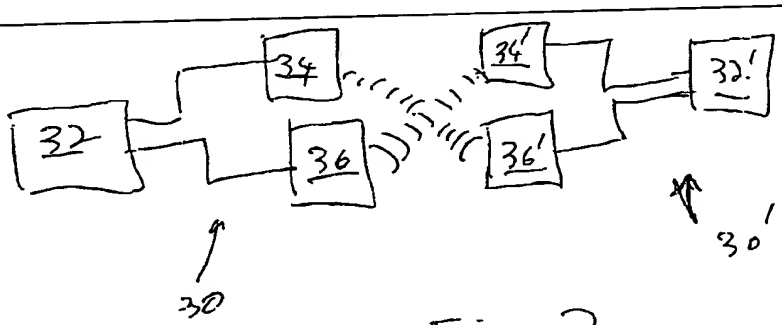

Fig 2

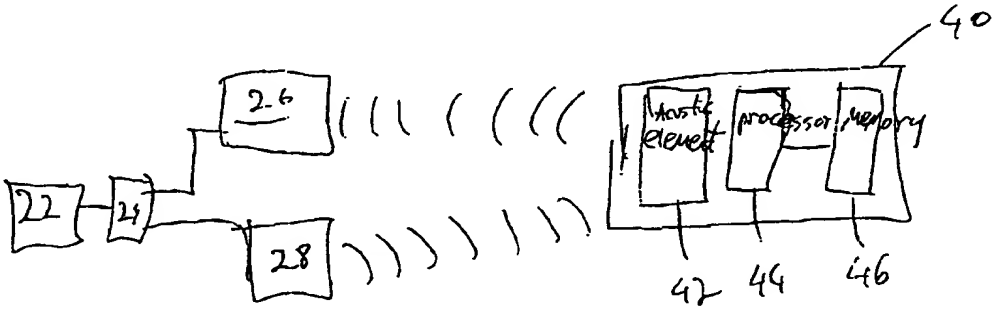

Fig 3

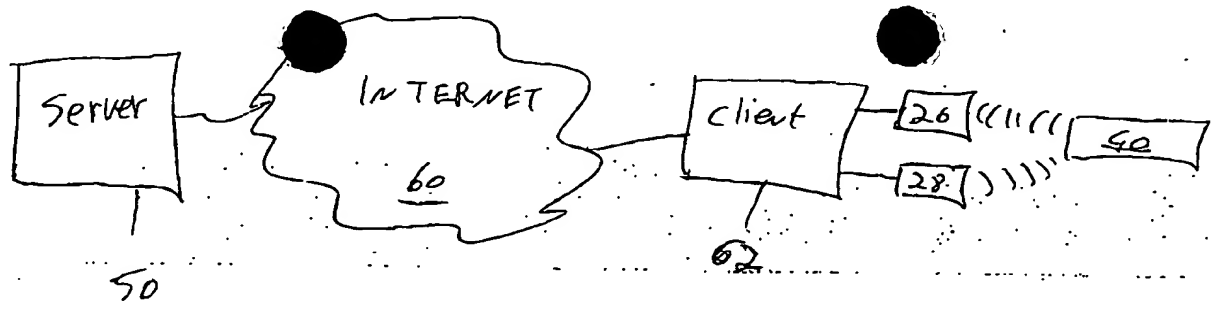

Fig 4

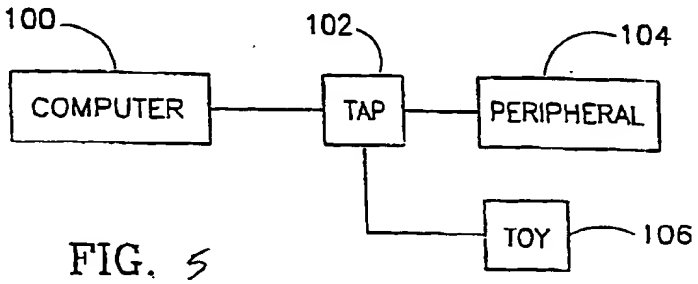

FIG. 5